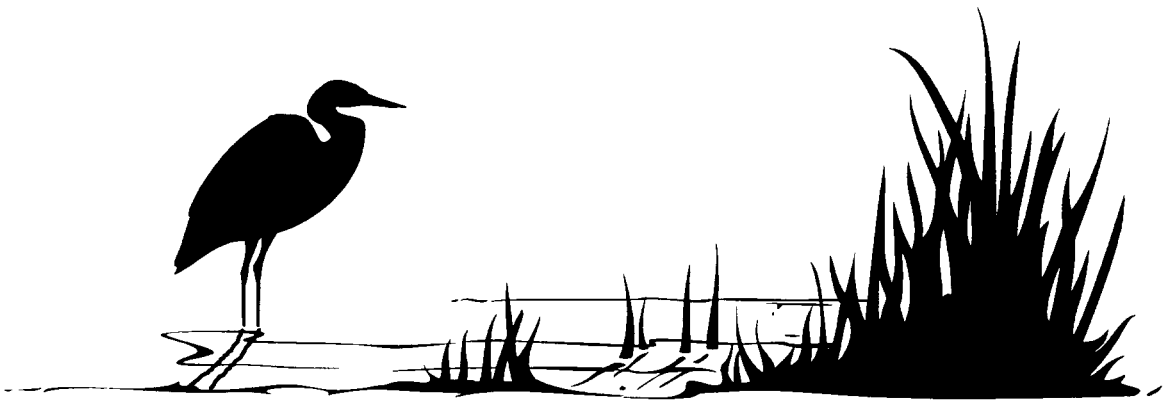
UDOT TEMPORARY EROSION AND SEDIMENT CONTROL MANUAL



A Guide for the Design, Installation, Inspection, and Maintenance of Temporary Erosion and Sediment Control Measures

February 2003

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PURPOSE & USE OF THE MANUAL

PURPOSE

Erosion control is becoming an increasingly large part of highway design and construction. UDOT must comply with current federal and state erosion control requirements and prepare to meet even more stringent requirements in the future. The development and implementation of an effective storm water pollution prevention plan (SWPPP) is essential.

This manual is intended to give designers, contractors, installers, and inspectors the tools they need to implement practical and efficient SWPPP's. Each section of this manual includes information on the design, installation, inspection and maintenance of temporary erosion control measures (TECMs). Proper use of these measures will protect the environment while saving the user time and money.

USE

The format of this manual facilitates its use. The TECM selection process has been streamlined through the use of a flowchart on page 4. The user identifies an erosion or sedimentation condition (ditch, slope, drop inlet protection, etc.) and is directed to an appropriate erosion/sediment control measure. The user is then directed to the appropriate page in the manual. Each TECM description contains information on design, placement, material specification, installation, inspection, and maintenance. If the user needs more information than is contained in this manual, a list of additional erosion control resources is included at the end of this manual.

UPDES REQUIREMENTS

For projects that disturb more than 1 acre of surface area, a Utah Pollutant Discharge Elimination System (UPDES) Permit is required prior to grading activities. It is very important that the permitee read the entire UPDES Permit to gain an understanding of the special conditions, management practices and responsibilities that the permitee has accepted. One important point often overlooked, is the timely application of stabilization and erosion control measures. UPDES regulations require that stabilization measures be initiated within 14 days after construction activity has permanently or temporarily ceased.

DESIGN OBJECTIVES

When developing a temporary erosion-control plan, decide which of the following three design objectives is most feasible for the project site:

Keep the soil at its original location.
Keep the soil close to its original location.
Keep the soil on site.

Keeping the soil at its original location is the preferred objective. This option causes the least amount of harm to the environment. Not only does this option protect the surrounding land and water, but it also prevents costly regrading and redressing of slopes and ditches. However, keeping the soil at its original location is not always feasible due to challenging topography and other site variables. If you can't keep the soil at its original location, at least try to keep it close. This option will require some regrading and redressing of slopes and ditches. Finally, if site conditions are such that neither of the first two objectives can be met, at least try to keep the soil from leaving the site. Soil transported off-site can cause far-reaching damage to the downstream environment. Loss of soil from the site should be avoided to the extent practicable.

SELECTION OF TEMPORARY EROSION AND SEDIMENT CONTROL MEASURES

The following table provides general guidance for the selection of appropriate erosion control measures. The selection of erosion control measures must be based on good judgement and past experience.

Item		Control Measure
Ditches	Grade $\leq$ 6%	Straw or Hay Bale Check Dam 8
	Grade $\geq$ 6% or High Flows?	Stone Check Dam 13
Slopes	Preservation of Natural Vegetation ..... 5 Surface Roughening ..... 6 Mulch ..... 7 Silt Fence Slope Barrier ..... 16 Slope Drain 20	
Drop Inlet Protection	Straw or Hay Bale Drop Inlet Barrier ..... 22 Silt Fence Drop Inlet Barrier ..... 26 Curb Inlet Barrier ..... 31 Stone Drop Inlet Barrier 33	
Potential for Sediment Discharge to Waters of the U.S.	Sediment Trap 35	
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SECTION 1 Preservation of Natural Vegetation

PURPOSE & OPERATION

It is important to preserve natural vegetation where possible. It is especially important to preserve vegetated areas adjacent to water bodies. As sheet flow runoff from surrounding areas passes over existing vegetation, sediment can filter out and runoff velocities are reduced. Existing vegetated cover facilitates pollutant removal through detention, filtration and infiltration into the soil layers. Vegetated buffers and filters can only accept overland sheet flow runoff. Avoid channelizing runoff from construction sites into these areas, they cannot treat runoff with high velocities.

Construction phasing can be effective in limiting the amount of disturbed area which is subject to erosive forces. Strip and grade areas such that the amount of time that the area is subject to erosion is kept at a minimum.

PURPOSE & OPERATION

Surface roughening is a method of erosion control that consists of mechanically creating an irregular surface on areas that have been disturbed. This irregular surface contains depressions that will collect water and sediment and facilitate infiltration of runoff into the soil. Rough grading is not effective in controlling runoff from heavy rainfall events.

Surfaces should be left in a rough condition until other more permanent methods of stabilization can be incorporated. Mulch or seed areas which will be exposed to erosive forces more than 60 days.

Rough grading can be achieved by operating a disk-type roller along the contours of the slope. For steeper slopes it may be necessary to employ "tracking" and operate a crawler tractor up and down the slope to achieve roughening. This will result in surface irregularities which are parallel to the natural contours of the slope.

SECTION 3 Mulch

PURPOSE & OPERATION

Mulching is a method of temporary stabilization where stabilizing materials are applied to disturbed surfaces. This is an important method of erosion control, it can prevent erosion from occurring at the source. Mulching protects the soil from rainfall impact and inhibits overland flow. Mulch also promotes the growth of vegetation by protecting the seed and fostering germination. Mulching is an effective method of temporary stabilization. Material stockpiles should be mulched to prevent erosion.

Areas recently seeded should have mulch applied immediately after seeding operations. Side slopes should be mulched as grading operations proceed. Mulch can be applied to stabilize Side slopes until the seeding operations begin.

Slopes should be mulched as grading operations proceed. If the timing of grading operations prohibits the application of seed, mulch can be applied to stabilize the slopes as a temporary measure.

PLACEMENT & INSTALLATION

Native Materials

Native materials stockpiled from clearing and grubbing operations can often be processed and used as mulch.

Straw Mulch

Straw is a common material for mulching and can be used in conjunction with seeding. Straw should be free from weed seeds. The method of application can be by hand or machine. Straw mulch should be applied to achieve a uniform depth of at least 2 inches over the disturbed surface. Straw mulch should be anchored to prevent it from being windblown. Loose straw can be applied in areas where wind is unlikely.

Use of a mulch anchoring tool, or crimper, can be an effective in anchoring straw mulch. A tractor drawn device is driven over the surface immediately after spreading the mulch. This device anchors the straw to the ground surface. Devices that could perform this function include a sheep's foot roller or a disk-type roller.

Fiber Mulch

Fiber mulch consists of wood cellulose or other cellulose fibers that are applied to the disturbed surface in a similar manner as hydroseeding. Fiber mulch can also be used for anchoring straw and is applied with a hydroseeder in accordance with the UDOT Standard Specification for Mulch.

SECTION 4 Straw or Hay Bale Check Dam

PURPOSE & OPERATION

Check Dams function by intercepting and ponding sediment-laden runoff. Ponding water reduces the velocity of the incoming flow and allows most of the suspended sediment to settle out. Water exits the check dam by flowing over the top. For ditches with steeper slopes and/or higher flows, an erosion control blanket on the downstream side of the check dam can serve as a scour apron that helps prevent further erosion.

DESIGN

Material Specification

- Check dam bales may be constructed of wheat straw, oat straw, prairie hay, or bromegrass hay that is free of weeds declared noxious by the State of Utah, Department of Agriculture.
- The stakes used to anchor the bales should be a hardwood material with the following minimum dimensions: 2 inches square (nominal) by 4 feet long.
- Twine should be used to bind bales. The use of wire binding is prohibited because it does not biodegrade readily.
- The downstream scour apron should be constructed of a double-netted straw erosion control blanket at least 6 feet wide.
- The metal landscape staples used to anchor the erosion-control blanket should be at least 8 inches long.

Placement

- Check dams should be placed **perpendicular** to the flowline of the ditch.
- Check dams should extend far enough so that the ground level at the end of the dam is higher than the center. This prevents water from flowing around the end of the check dam.
- Straw or hay bale check dams should not be placed in ditches where high flows are expected. Stone check dams should be used instead.
- Bales should be placed in ditches with slopes of 6% or less. For slopes steeper than 6%, use rock check dams.

Check Dam Spacing

The following table provides check spacing for a given ditch grade:

Ditch grade	Check Dam Spacing
%	(Feet)
1.0	200
2.0	100
3.0	65
4.0	50
5.0	40
6.0	30

INSTALLATION

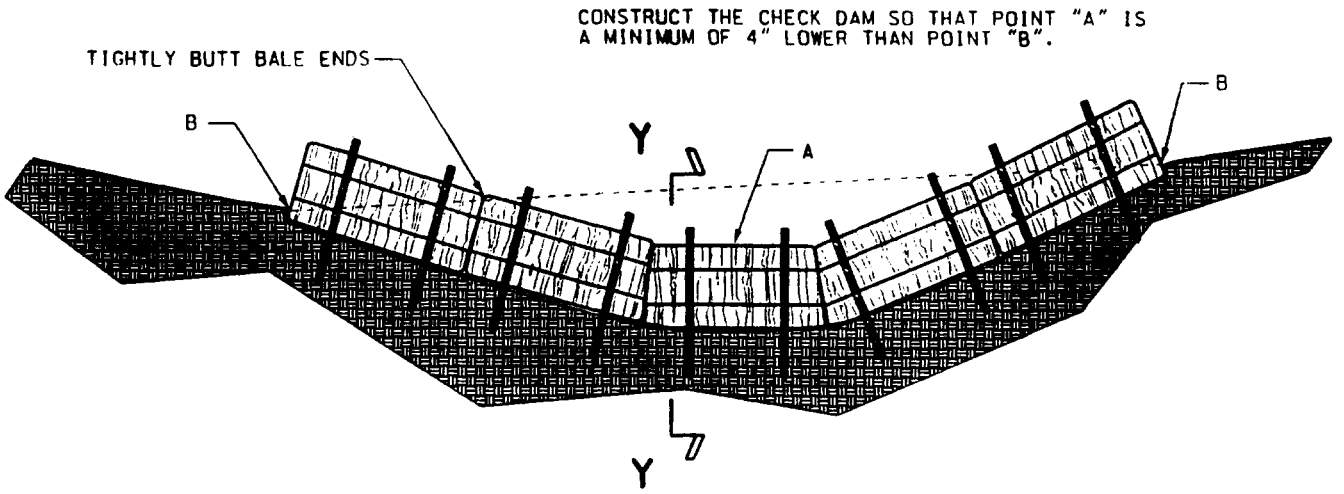
Proper installation method

- Excavate a trench perpendicular to the ditch flowline that is 6 inches deep and a bale's width wide. Extend the trench in a straight line along the entire length of the proposed ditch check. Place the soil on the upstream side of the trench-it will be used later.

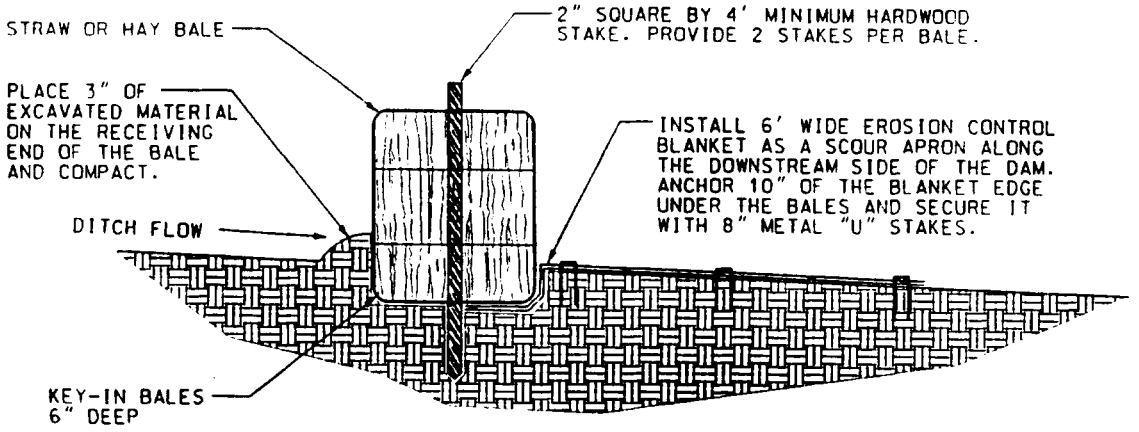
- **Optional:** On the downstream side of the trench, roll out a length of erosion-control blanket (scour apron) equal to the length of the trench. Place the upstream edge of the erosion-control blanket along the bottom upstream edge of the trench. The erosion control blanket should be anchored in the trench with one row of 8 inch landscape staples placed on 18 inch centers. The remainder of the erosion-control blanket (the portion that is not lying in the trench) will serve as the downstream scour apron. This section of the blanket should be anchored to the ground with 8 inch landscape staples placed around the perimeter of the blanket on 18 inch centers. The remainder of the blanket should be anchored using two evenly spaced rows of 8 inch landscape staples on 18 inch centers placed perpendicular to the flowline of the ditch.

- Place the bales in the trench, making sure that they are butted tightly. Two stakes should be driven through each bale along the centerline of the ditch check, approximately 6 to 8 inches in from the bale ends. Stakes should be driven **at least** 18 inches into the ground.

- Once all the bales have been installed and anchored, place the excavated soil against the upstream side of the bales and compact. The compacted soil should be no more than 3 to 4 inches deep and extend upstream no more than 24 inches.



STRAW OR HAY BALE CHECK DAM



SECTION Y - Y

List of common placement/installation mistakes to avoid.

- Do not place a straw or hay bale check dam directly in front of a culvert outlet.
- Do not place a straw or hay bale check dam in ditches that will likely experience high flows.
- Follow the prescribed spacing guidelines. If spacing guidelines are exceeded, erosion will occur between the check dams.
- Do not allow water to flow around the ckeck dam. Make sure that the check dam is long enough so that the gound level at the ends of the dam is higher than the top of the lowest bale.
- Do not place a straw or hay bale check dam in channels with shallow soils underlain by rock. If the dam is not anchored sufficiently, it will fail.

- Straw and hay bale check dams must be placed below the natural ground surface. If they are placed at the ground surface, they could allow water to flow under the dam.

INSPECTION & MAINTENANCE

Bale check dams should be inspected every 7 days and within 24 hours of a rainfall of 0.5 inch or more. The following is a list of questions that should be addressed during each inspection:

Does water flow around the check dam?

This is usually caused by insufficient check dam length. If this occurs, extend the check dam far enough so that the ground level at the ends of the dam is higher than the top of the lowest center bale.

Does water flow under the check dam?

This is usually caused by not trenching in the bales deep enough (at least 6 inches) or insufficient compaction of soil upstream of the check dam. If the problem is insufficient compaction, add more soil directly upstream of the check and recompact. If the problem is improperly trenched bales, the entire check should be removed and a new one installed using the proper trench depth.

Does water flow through spaces between abutting bales?

This is usually caused by not butting the bales tight enough during initial installation. Stuffing loose bale material between the bales to fill up the space can usually solve this problem.

Are any bales and/or scour aprons (optional) dislodged?

Check to see if any bales or scour aprons have become dislodged from their original position. Dislodged bales and scour aprons should be repositioned and restaked if they are still reusable--otherwise, replace them.

Are bales decomposing due to age and/or water damage?

Under normal conditions, the maximum useful life of a bale is normally 3 months (but may be longer during prolonged dry periods). Inspect the bales for signs of decomposition and replace as necessary.

Does sediment need to be removed from behind the check dam?

Sediment accumulated behind the check dam should be removed when it reaches one-half of the original exposed height of the bales. Allowing too much sediment to accumulate behind a check dam drastically reduces its effectiveness. One high intensity rainfall can dislodge enough sediment from surrounding slopes to completely fill the space behind the check dam. This is why it is

extremely important to inspect check dams within 24 hours of a large rainfall.

When removing sediment from behind a bale check dam with a bulldozer or backhoe, take care not to undermine the entrenched bales.

PURPOSE & OPERATION

Stone check dams function by intercepting and ponding sediment-laden runoff. Ponding the water dissipates the energy of incoming flows and allows a large portion of the suspended sediment to settle out. Water exits the check dam by percolating through the dam or by flowing over its crest.

DESIGN

Placement

- Stone check dams should be placed **perpendicular** to the flowline of the ditch.
- Stone check dams must be designed so that water can flow over them, not around them. The check dam should extend far enough so that the ground level at the ends of the dam is higher than the low point in the center.
- Stone check dams should not be placed in natural stream channels.

Check Dam Spacing

The following table provides check dam spacing for a given ditch grade:

Ditch grade	Check Dam Spacing
%	(Feet)
5.0	60
6.0	50
7.0	40
8.0	35
9.0	32
10.0	30

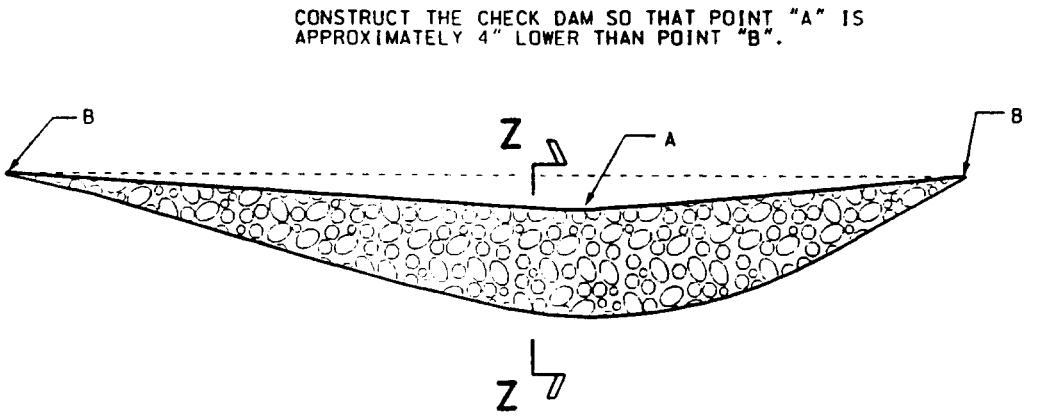
Stone Size

It is recommended that the stone be well graded, ranging from 0.5 to 1.5 inches.

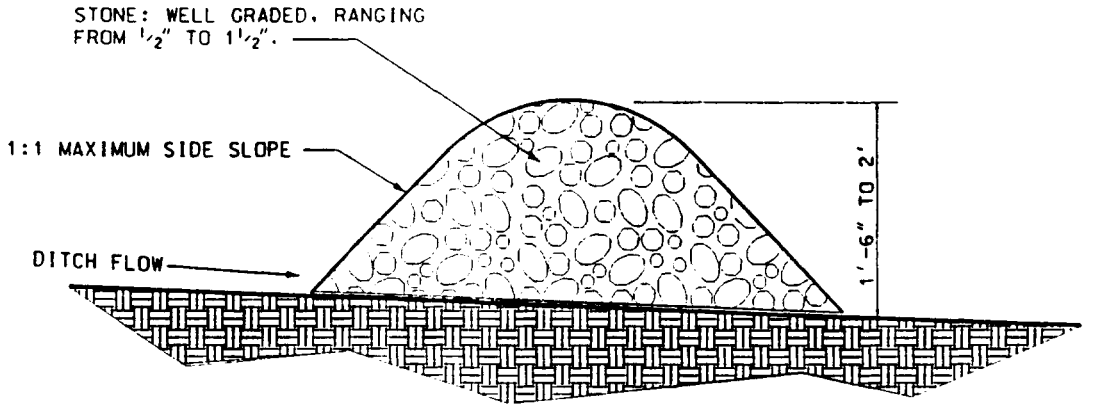
INSTALLATION

Proper installation method:

Using approved stone, construct a stone check dam perpendicular to the ditch flowline. The check dam should be 1.5 to 2 feet high and have side slopes no steeper than 1:1. The check dam must be constructed so that water can **flow over the top, not around the ends** (i.e., the ground level at the ends of the check must be higher than the low point on the crest of the dam).



STONE CHECK DAM



SECTION Z - Z

List of common placement/installation mistakes to avoid

- Follow prescribed check dam spacing guidelines. If spacing guidelines are exceeded, erosion will occur between the check dams.

- Do not allow water to flow around the check dam. Make sure that the check dam is long enough so that the ground level at the ends of the dam is higher than the low point on the crest of the dam.

INSPECTION & MAINTENANCE

Stone check dams should be inspected every 7 days and within 24 hours of a rainfall of 0.5 inch or more. The following is a list of questions that should be addressed during each inspection:

- ***Does water flow around the check dam?***
  This is usually caused by insufficient check dam length. If this occurs, extend the check a sufficient length so that the ground level at the ends of the check is higher than the low point on the crest of the check.

- ***Have high-velocity flows displaced any stones from the check?***
  Sometimes high-velocity flows can carry away portions of a rock check dam. After a large rainstorm, inspect the stone check dam for any displaced stones. If a large portion of a stone check dam has washed away, fill in the void with new stone immediately.

- ***Does sediment need to be removed from behind the check dam?***
  Sediment accumulated behind the check dam should be removed when it reaches one-half of the original exposed height of the stone check dam. Allowing too much sediment to accumulate behind a check dam drastically reduces its effectiveness. One high intensity rainfall can dislodge enough sediment from surrounding slopes to completely fill the space behind the check dam. This is why it is extremely important to inspect check dams within 24 hours of a large rainfall. The easiest way to remove sediment from behind a stone check dam is with a bulldozer or backhoe.

PURPOSE & OPERATION

Silt-fence slope barriers operate by intercepting and ponding sediment-laden slope runoff. Ponding the water reduces the velocity of the incoming flow and allows most of the suspended sediment to settle out. Water exits the silt-fence slope barrier by percolating through the silt fence.

DESIGN

Material Specification

- Silt-fence fabric should conform to the AASHTO M288.

- The posts used to support the silt-fence fabric should be a hardwood material with the following minimum dimensions: 2 inches square (nominal) by 4 feet long.

- Silt-fence fabric should be attached to the wooden posts with staples, wire, zip ties, or nails.

Placement

- A slope barrier should be used at the toe of a slope when a ditch does not exist. The slope barrier should be placed on nearly level ground 5 to 10 feet away from the toe of a slope. The barrier is placed away from the toe of the slope to provide adequate storage for settling out sediment.

- When practicable, silt-fence slope barriers should be placed along contours to avoid a concentration of flow.

- Silt-fence slope barriers can also be placed along right-of-way fence lines to keep sediment from crossing onto adjacent property. When placed in this manner, the slope barrier will not likely follow contours.

INSTALLATION

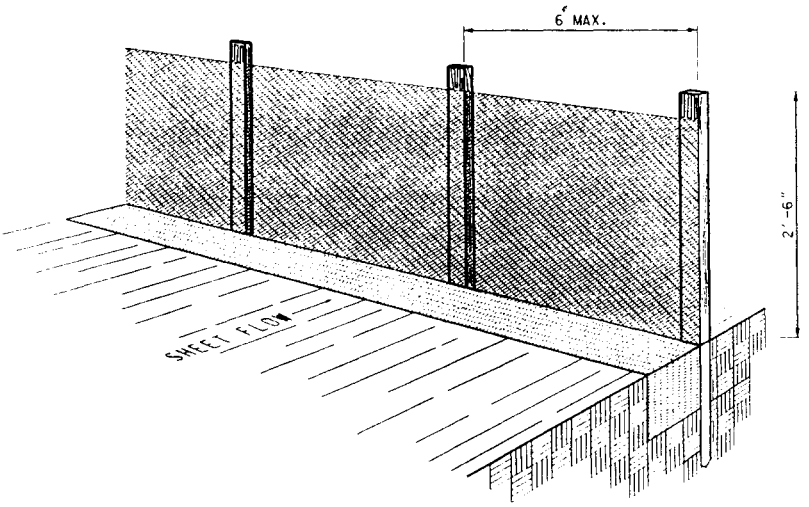
Proper installation method

- Excavate a trench the length of the planned slope barrier that is 6 inches deep by 4 inches wide. Make sure that the trench is excavated along a single contour. **When practicable, slope barriers should be placed along contours to avoid a concentration of flow.** Place the soil on the up slope side of the trench for later use.

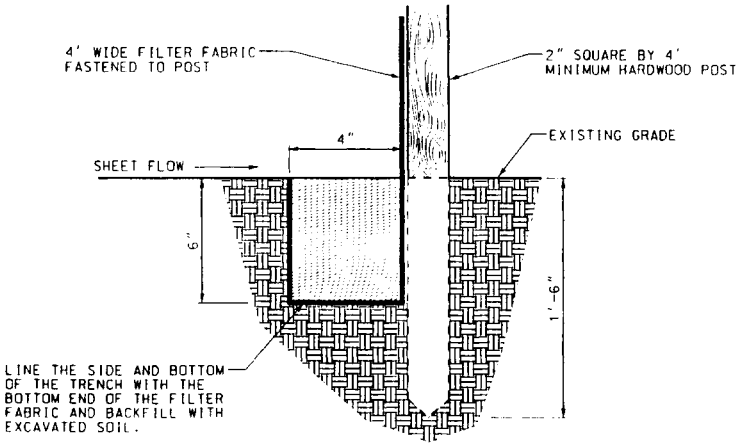
- Roll out a continuous length of silt-fence fabric on the down slope side of the trench. Place the edge of the fabric in the trench starting at the top up slope edge. Line all three sides of the trench with the fabric. Backfill over the fabric in the trench with the excavated soil and compact.

- Lay the exposed silt fence up slope of the trench to clear an area for driving in the posts. Just down slope of the trench, drive posts into the ground to a depth of at least 18 inches. Place posts no more than 6 feet apart.

- Attach the silt fence to the anchored post with staples, wire, zip ties, or nails.



PERSPECTIVE VIEW



SECTION

List of common placement/installation mistakes to avoid

- When practicable, do not place silt-fence slope barriers across contours. **Slope barriers should be placed along contours to avoid a concentration of flow.** When the flow concentrates, it overtops the barrier and the silt-fence slope barrier quickly deteriorates.

- Do not place silt-fence posts on the up slope side of the silt-fence fabric. In this configuration, the force of the water is not restricted by the posts, but only by the staples (wire, zip ties,. nails, etc.). The silt fence will rip and fail.

- Do not place silt fence slope barriers in areas with shallow soils underlain by stone. If the barrier is not sufficiently anchored, it will wash out.

- Silt-fence slope barriers must be dug into the ground-silt fence at ground level does not work because water will flow underneath.

INSPECTION & MAINTENANCE

Silt-fence slope barriers should be inspected every 7 days and within 24 hours of a rainfall of 0.5 inch or more. The following is a list of questions that should be addressed during each inspection:

- ***Are there any points along the slope barrier where water is concentrating?*** When slope barriers are not placed along contours, water concentrates at low points of the slope barrier. This concentrated flow usually causes a failure of the slope barrier. Even if the barrier does not fail, the concentration of flow drastically reduces the overall storage capacity of the slope barrier. The only solution to this problem is reinstalling the slope barrier (or sections of it) so that it is level.

- ***Does* water flow *under the slope barrier?***
  This can be caused by posts that are too far apart, a trench that is too shallow, or an improper burial procedure. Posts should be no more than 6 feet apart. The trench should be at least 4 inches wide by 6 inches deep. The bottom edge of the silt fence should be anchored securely by backfilling over the fabric in the trench with the excavated soil and then compacting. If these guidelines have not been met, the silt fence slope barrier should be re-installed or the deficiencies should be remedied.

- ***Does the silt-fence sag excessively?***
  Sagging silt fence is caused by excessive post spacing and/or overtopping of the silt fence. Silt-fence posts should be no more than 6 feet apart. If the post spacing exceeds 6 feet, additional posts should be added to decrease spacing between posts. Water should flow through a silt-fence slope barrier-not over it. Silt-fence

installations quickly deteriorate when water overtops them. If a silt-fence slope barrier is regularly overtopped, it has probably been placed in a location that receives flows beyond its intended capacity. If this is the case, discontinue the use of silt-fence in this area and try something different (e.g.-bale slope barriers).

- ***Has the silt fence torn or become detached from the posts?***
  Silt fence can be torn by the force of ponded water, or by winds that rip the silt-fence fabric away from the posts. If a silt fence develops tears for any reason, it should be replaced.

- ***Does sediment need to be removed from behind the slope barrier?***
  Sediment accumulated behind the slope barrier should be removed when it reaches one-half of the original exposed height of the silt fence. Allowing too much sediment to accumulate behind a slope barrier drastically reduces its effectiveness. One high intensity rainfall can dislodge enough sediment from surrounding slopes to completely fill up the space behind the slope barrier. This is why it is extremely important to inspect slope barriers within 24 hours of a large rainfall. When removing sediment from behind a silt-fence slope barrier with a bulldozer or backhoe, take care not to undermine the entrenched silt fence.

PURPOSE & OPERATION

A slope drain is a drainage system used to collect and transport storm runoff down the face of a slope. This system usually consists of a berm at the top of the slope, a pipe culvert with end sections and outlet protection. This is a temporary measure that is used during grading operations until the permanent drainage features are installed. The pipe material used is typically corrugated polyethylene.

DESIGN

Slope drains should be designed to collect and transport storm runoff from a two year storm event. Pipe diameter size should be 12 inch. For large drainage areas, pipe diameter could be determined using UDOT culvert design procedures.

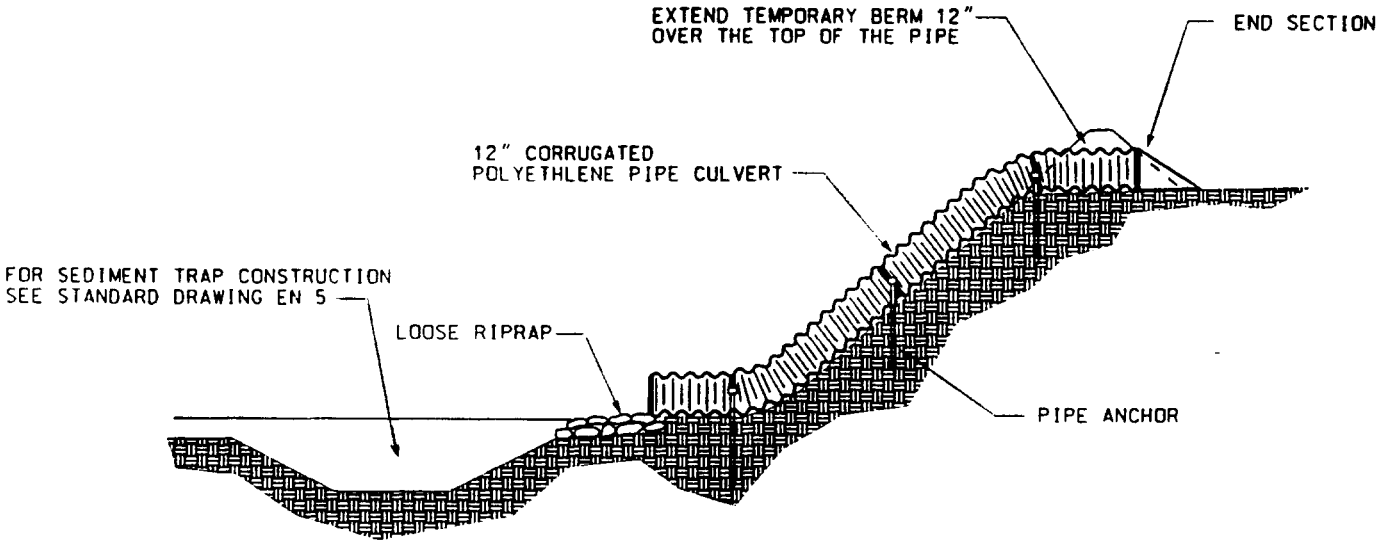
Slope drains should be constructed with berms which are not overtopped. At the pipe inlet the top of the berm should be a minimum of 1 foot higher than the top of the pipe. The inlet should have a standard flared end section. The pipe inlet should be 6 inches lower than the flow line of the ditch. The outlet should be protected with rip-rap or other approved energy dissipation feature. It is preferable if the slope drain emptied directly into a sediment basin.

INSTALLATION

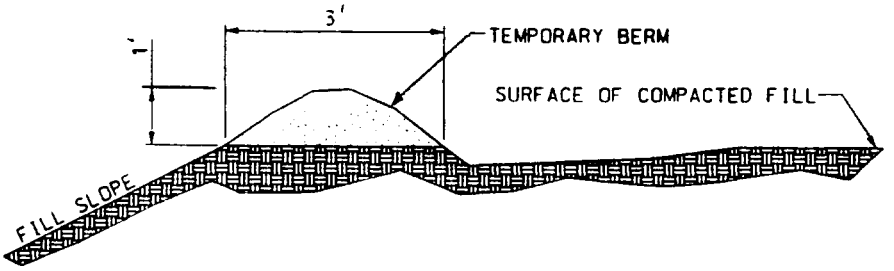
- Place slope drains on undisturbed or well compacted material at the sites specified.
- Hand tamp the soil under and around the entrance in 6 inch lifts.
- Use water-tight fittings at all slope drain connections.
- Secure pipe to slope at 10 foot spacings.
- Extend the drain beyond the toe of the slope and provide outlet protection
- Construct the berm 1 foot above the top of the pipe. Compact and stabilize the berm.

INSPECTION & MAINTENANCE

Slope drains should be inspected weekly and after every rainfall. Any erosion of the slope, berm or outlet should be repaired immediately. After the slope has been permanently stabilized and the permanent drainage system is in place, the temporary slope drains may be removed.



SLOPE DRAIN SECTION



TEMPORARY BERM

PURPOSE & OPERATION

Bale drop-inlet barriers operate by intercepting and ponding sediment-laden runoff. Ponding the water reduces the velocity of the incoming flow and allows most of the suspended sediment to settle out. When the pond height reaches the top of the barrier, water flows over the bales and into the drop inlet.

DESIGN

Material Specification

Bale drop-inlet barriers should be constructed of wheat straw, oat straw, prairie hay, or bromegrass hay that is free of weeds declared noxious by the State of Utah, Department of Agriculture.

- The stakes used to anchor the bales should be a hardwood material with the following minimum dimensions: 2 inches square (nominal) by 6 feet long.

- Twine should be used to bind bales. The use of wire binding is prohibited because it does not biodegrade readily.

Placement

- Bale drop-inlet barriers should be placed directly around the perimeter of a drop inlet.

- When a bale drop-inlet barrier is located near an inlet that has steep approach slopes, the storage capacity behind the barrier is drastically reduced. Timely removal of sediment must occur for a barrier to operate properly in this location.

INSTALLATION

Proper installation method

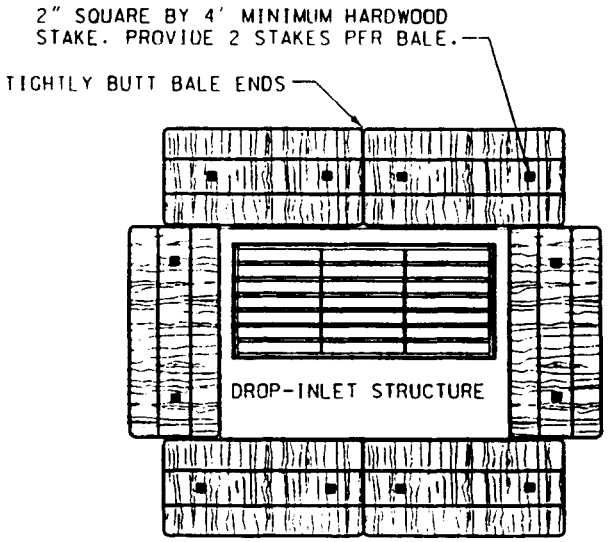
- Excavate a trench around the perimeter of the drop inlet that is at least 6 inches deep by a bale's width wide.

- Place the bales in the trench, making sure that they are butted tightly. Some bales may need to be shortened to fit into the trench around the drop inlet. Two stakes should be driven through each bale, approximately 6 to 8 inches in from the bale ends. Stakes should be driven **at least** 18 inches into the ground.

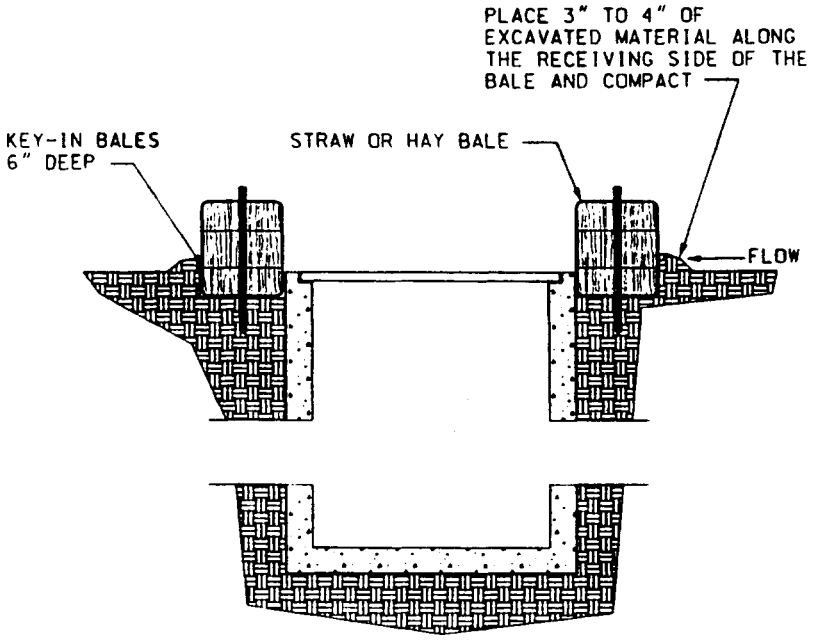
- Once all the bales have been installed and anchored, place the excavated soil against the receiving side of the barrier and compact it. The compacted soil should be no more than 3 to 4 inches deep.

- **Note:** When a bale drop-inlet barrier is placed in a shallow median ditch, make sure that the top of the barrier is not higher than the paved road. In this configuration, water may spread onto the roadway causing a hazardous condition.

STRAW AND HAY BALE
DROP-INLET BARRIER



PLAN VIEW



SECTION

List of common placement/installation mistakes to avoid

Bales should be placed directly against the perimeter of the drop inlet. This allows overtopping water to flow directly into the inlet instead of onto nearby soil causing scour.

- Bale drop-inlet barriers must be dug into the ground. Bales at ground level do not work because they allow water to flow under the barrier.

INSPECTION & MAINTENANCE

Bale drop-inlet barriers should be inspected every 7 days and within 24 hours of a rainfall 0.5 inch or more. The following is a list of questions that should be addressed during each inspection:

- ***Does water flow under the drop-inlet barrier?***
  This is usually caused by not trenching in the bales deep enough (at least 6 inches) or insufficient compaction of soil around the barrier. If the problem is insufficient compaction, add more soil around the base of the barrier and re-compact. If the problem is improperly trenched bales, the drop-inlet barrier should be removed and a new one installed using the proper trench depth.

- ***Does water flow through spaces between abutting bales?***
  This is usually caused by not butting the bales tight enough during initial installation. Stuffing loose bale material between the bales to fill up the space can usually solve this problem.

- ***Are any bales dislodged?***
  Check to see if any bales have become dislodged from their original position. Dislodged bales should be repositioned and restaked if they are still reusable, otherwise, replace them.

  A dislodged bale should be repaired immediately because it has the potential to create bigger problem: **flooding.** If a bale falls over onto a drop inlet during a storm, the inlet can become blocked, causing flooding of the roadway.

- ***Are bales decomposing due to age and/or water damage?***
  Under normal conditions, the maximum useful life of a bale is normally 3 months (but may be longer during prolonged dry periods). Inspect the bales for signs of decomposition and replace as necessary.

- ***Does sediment need to be removed from behind the drop-inlet barrier?***
  Sediment accumulated behind the drop-inlet barrier should be removed when it reaches one-half of the original exposed height of the bales. Allowing too much sediment to accumulate behind a drop-inlet barrier drastically reduces its

effectiveness. One high intensity rainfall can dislodge enough sediment from the drainage basin to completely fill the space behind the drop-inlet barrier. This is why it is extremely important to inspect drop-inlet barriers within 24 hours of a large rainfall.

When removing sediment from behind a bale drop-inlet barrier with a bulldozer or backhoe, take care not to undermine the entrenched bales.

SECTION 9 Silt Fence Drop Inlet Barrier

PURPOSE & OPERATION

Silt-fence drop inlet barriers function similar to a check dam or a slope barrier: the Silt fence intercepts, ponds, and filters sediment-laden runoff. Ponding the water reduces the velocity of the incoming flow and allows most of the suspended sediment to settle out. As the ponded water percolates through the silt-fence fabric, much of the remaining suspended sediment is filtered out.

DESIGN

Material Specification

- Silt-fence fabric should conform to the AASHTO M288.
- The posts used to support the silt-fence fabric should be a hardwood material with the following minimum dimensions: 2 inches square (nominal) by 6 feet long.
- The material used to frame the tops of the posts should be 2 inch by 4 inch (nominal) boards.
- Silt-fence fabric and support backing should be attached to the wooden posts and frame with staples, wire, zip ties, or nails.

Placement

- Place a silt-fence drop-inlet barrier in a location where it is unlikely to be overtopped. Water should flow through silt-fence, not over it. Silt-fence drop-inlet barriers often fail when repeatedly overtopped.
- When used as a drop-inlet barrier, silt-fence fabric and posts must be supported at the top by a wooden frame.
- When a silt-fence drop-inlet barrier is located near an inlet that has steep approach slopes, the storage capacity behind the barrier is drastically reduced. Timely removal of sediment must occur for a barrier to operate properly in this location.

INSTALLATION

Proper installation method

- Excavate a trench around the perimeter of the drop inlet that is at least 6 inches deep by 4 inches wide.

- Drive posts to a depth of at least 16 inches round the perimeter of the drop inlet. The distance between posts should be 6 feet or less. If the distance between two adjacent corner posts is more than 6 feet, add another post(s) between them.

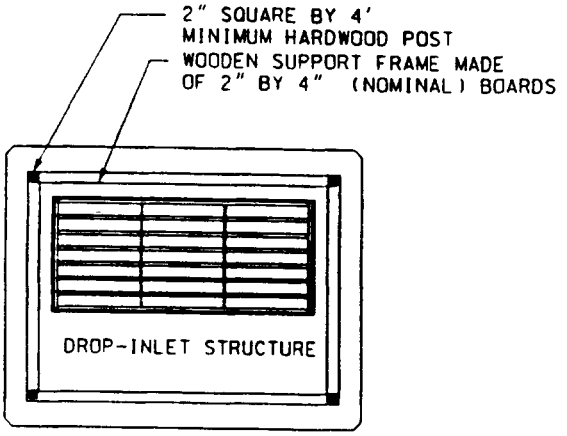
- Connect the tops of all the posts with a wooden frame made of 2 inch by 4 inch (nominal) boards. Use nails or screws for fastening.

- Roll out a continuous length of silt-fence fabric long enough to wrap around the perimeter of the drop inlet. Add more length for overlapping the fabric joint. Place the edge of the fabric in the trench, starting at the outside edge of the trench. Line all three sides of the trench with the fabric. Backfill over the fabric in the trench with the excavated soil and compact. After filling the trench, approximately 2.5 feet of silt-fence fabric should remain exposed.

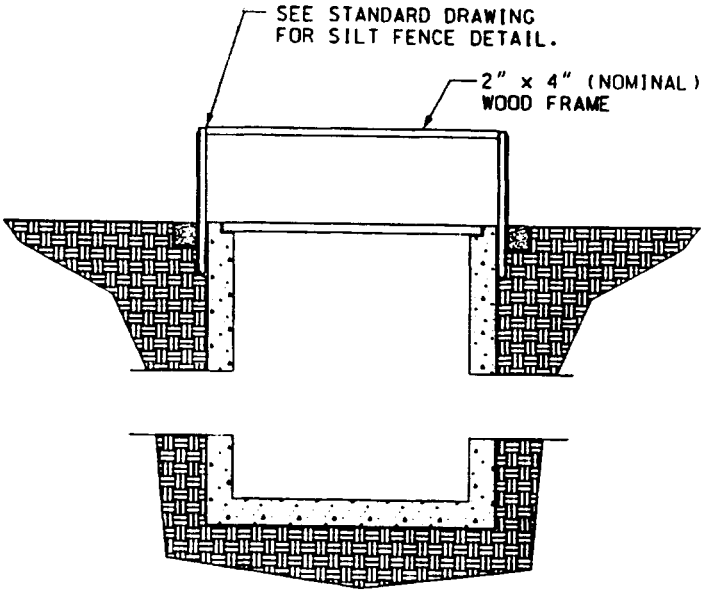
- Attach the silt fence to the **outside** of the post/frame structure with staples, wire, zip ties, or nails. The joint should be overlapped to the next post.

- **Note:** When a silt-fence drop-inlet barrier is placed in a shallow median ditch, make sure that the top of the barrier is not higher than the paved road. In this configuration, water may spread onto the roadway causing a hazardous condition.

SILT FENCE
DROP-INLET BARRIER



PLAN VIEW



SECTION

List of common placement/installation mistakes to avoid

Water should flow through a silt-fence drop-inlet barrier-not over it. Place a silt fence drop inlet barrier in a location where it is unlikely to be overtopped. Silt-fence drop-inlet barriers often fail when repeatedly overtopped.

- Do not place posts on the outside of the silt-fence drop-inlet barrier. In this configuration, the force of the water is not resisted by the posts, but only by the staples (wire, zip-ties, nails, etc.). The silt fence will rip and fail.

- Do not install silt-fence drop-inlet barriers without framing the top of the posts. The corner posts around drop inlets are stressed in two directions whereas a normal silt fence is only stressed in one direction. This added stress requires more support.

INSPECTION & MAINTENANCE

Silt-fence drop-inlet barriers should be inspected every 7 days and within 24 hours of a rainfall of 0.5 inch or more. The following is a list of questions that should be addressed during each inspection:

- ***Does water flow under the silt fence?***

This can be caused by posts that are too far apart, a trench that is too shallow, or an improper burial procedure. Posts should be no more than 6 feet apart. The trench should be at least 4 inches wide by 6 inches deep. The bottom edge of the silt fence should be anchored securely by backfilling over the fabric in the trench with the excavated soil and then compacting. If these guidelines have not been met, the silt fence drop-inlet barrier should be re-installed or the deficiencies should be remedied.

- ***Does the silt-fence sag excessively?***

Sagging silt fence is caused by excessive post spacing or the lack of a frame connecting the posts. Silt-fence posts should be no more than 6 feet apart. If the post spacing exceeds 6 feet, additional posts should be added to decrease spacing between posts. If no post frame exists, one should be added.

A sagging silt fence should be repaired immediately because it has the potential to create bigger problem: **flooding.** If a silt fence falls over onto a drop inlet during a storm, the inlet can become blocked, causing flooding of the roadway.

- ***Has the silt fence torn or become detached from the posts?***

Silt-fence can be torn by the force of ponded water, or by winds that rip the silt-fence fabric away from the posts. If a silt fence develops tears for any reason, it should be replaced.

- ***Does sediment need to be removed from behind the drop-inlet barrier?***

Sediment accumulated behind the drop-inlet barrier should be removed when it reaches one-half of the original exposed height of the silt fence. Allowing too much sediment to accumulate behind a drop-inlet barrier drastically reduces its effectiveness. One high intensity rainfall can dislodge enough sediment from the drainage basin to completely fill the space behind the drop-inlet barrier. This is why it is extremely important to inspect drop-inlet barriers within 24 hours of a large rainfall. When removing sediment from behind a silt-fence drop-inlet barrier with a bulldozer or backhoe, take care not to undermine the entrenched silt fence.

SECTION 10 Curb Inlet Barrier

PURPOSE & OPERATION

Inlet protection is a "last chance" effort to remove sediment from storm runoff before it enters the storm drain system. The method of inlet protection to be used depends on the type of inlet. Types of inlets commonly used include grates and curb inlets. These types are physically different and require different methods of protection. Sediment is removed from storm runoff by using a gravel filter to separate sediment from runoff.

DESIGN

Material Specification

- Concrete masonry block should conform to the ASTM C90 specification.
- Stone should be well graded with a size of 0.5 to 1.5 inches.
- Wood studs should be 2 inches by 4 inches (nominal).
- Wire mesh should have an opening size of 0.5 inch by 0.5 inch.

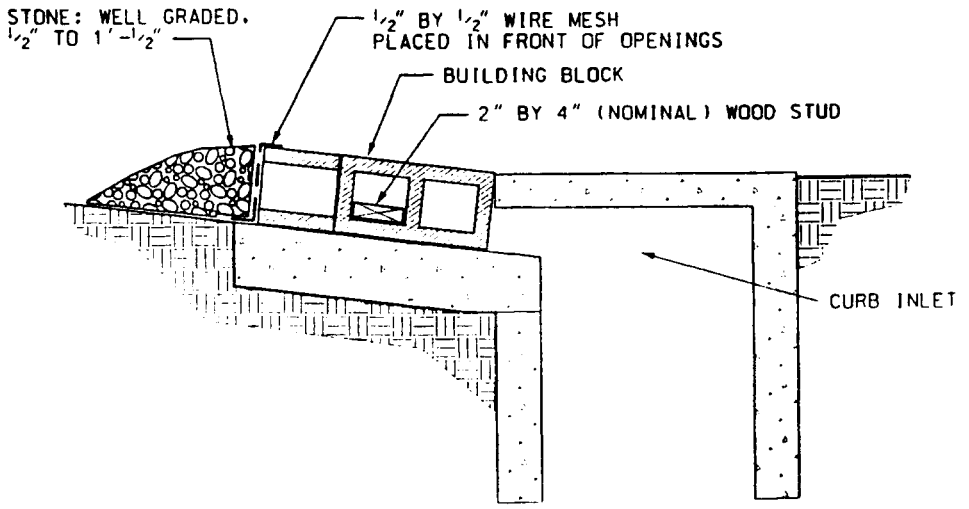
INSTALLATION

Concrete blocks are placed around the entrance to the inlet. Free draining stone is then placed up against the wire mesh, up to the top of the concrete block. All storm runoff must pass through this stone filter before entering the inlet. See the figure on the following page.

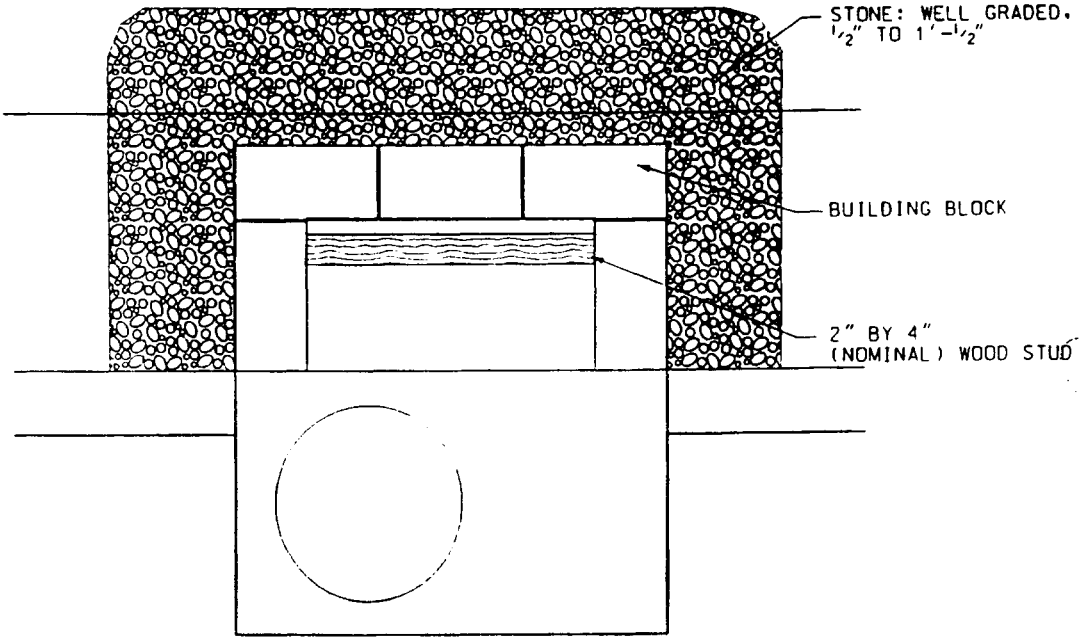
INSPECTION & MAINTENANCE

Curb opening inlets should be inspected weekly and after a storm event. Common failures include clogging of the wire mesh and gravel. Damaged materials should be repaired immediately. Accumulated sediment should be removed after a storm event and properly disposed of. When the disturbed areas have been stabilized the protection can be removed.

CURB INLET BARRIER



SECTION



PLAN VIEW

GENERAL NOTES:

1. PLACE BUILDING BLOCKS, WIRE MESH AND STONE AS SHOWN AROUND THE CURB INLETS.
2. MAINTAIN A PROPERLY FUNCTIONING STONE BARRIER THROUGHOUT CONSTRUCTION OR UNTIL DISTURBED AREAS CONTRIBUTING TO THE INLET HAVE BEEN PAVED OR VEGETATED.
3. REMOVE SEDIMENT AS IT ACCUMULATES AND PLACE IT IN A STABLE AREA APPROVED BY THE ENGINEER.

SECTION 11 Stone Drop Inlet Barrier

PURPOSE & OPERATION

Stone drop inlet barriers intercept, pond, and filter sediment-laden runoff. Ponding the water reduces the velocity of the incoming flow and allows most of the suspended sediment to settle out. As the ponded water percolates through the free draining stone, much of the remaining suspended sediment is filtered out.

DESIGN

Material Specification

- Stone should be well graded with a size of 0.5 inch to 1.5 inch.

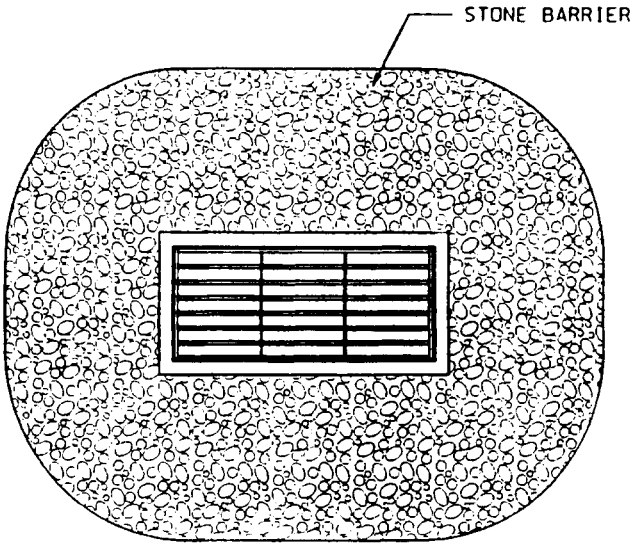
INSTALLATION

Place stone around the inlet opening 1.5 to 2 feet high with a maximum side slope of 1:1. In median areas, ensure that the top of the stone barrier is not higher than the adjacent roadway. All storm runoff must pass through this stone filter before entering the inlet. See the figure on the following page .

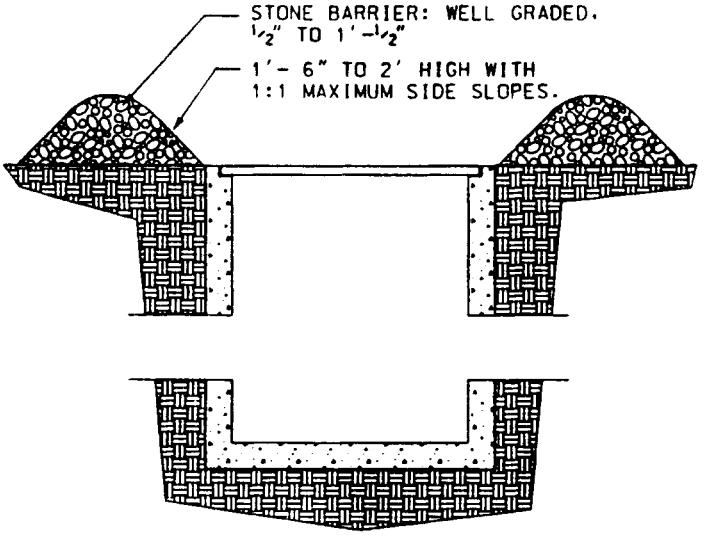
INSPECTION & MAINTENANCE

Stone drop inlet barriers should be inspected weekly and after each storm event. Accumulated sediment should be removed after a storm event and properly disposed of. Maintain a properly functioning stone barrier throughout construction or until disturbed areas contributing to the inlet have been stabilized.

STONE
DROP-INLET BARRIER



PLAN VIEW



SECTION

PURPOSE & OPERATION

Sediment traps collect and store sediment transported by streams and ditches. Their function is to protect adjacent properties and waters of the United States from pollution resulting from the discharge of sediment. Sediment laden runoff flows into this type of facility where velocities are slowed and sediment is allowed to settle out.

DESIGN

The project engineer should estimate the size of sediment trap needed. Consideration should be given to the expected volume of runoff as well as the amount of sediment to be collected.

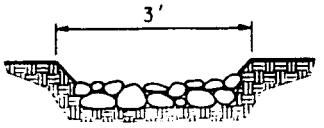
- The sediment trap should be sized to accommodate a minimum of 1 inch of runoff from the tributary drainage area.
- Inlet and outlet channels should be lined with loose rip-rap
- Side slopes should be 1:2 (V:H) or flatter

INSTALLATION

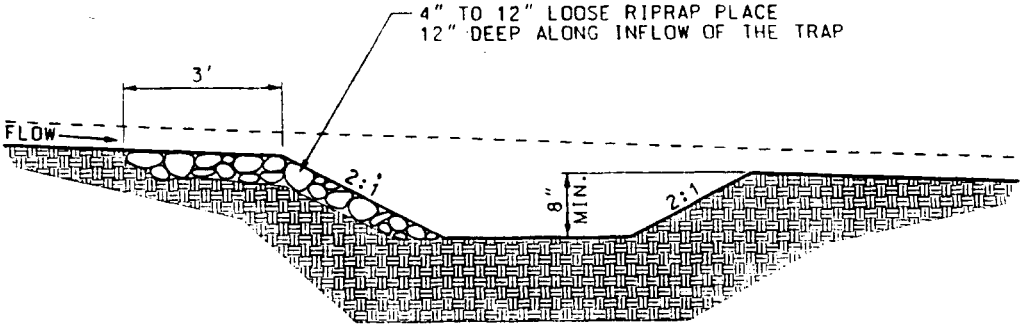
Proper installation method

- Sediment traps can be used in many locations to collect sediment and discharge storm runoff from the construction site to downstream waters. Applicable locations include discharge points from slope drains, the toe of embankments, low points of a waste area or borrow pit and down grade from cut sections. Sediment traps should be constructed close to the source of sediment, but outside of existing water courses. They should never be constructed in a streambed, their purpose is to treat storm water only from the construction site. Try to use natural depressions and existing topography if possible.
- Sediment traps must be designed and located such that failure would not result in loss of life, damage to homes, businesses, transportation facilities or public utilities.
- In areas where sediment traps are considered to be a safety hazard, they are to be fenced or provided with warning signs.

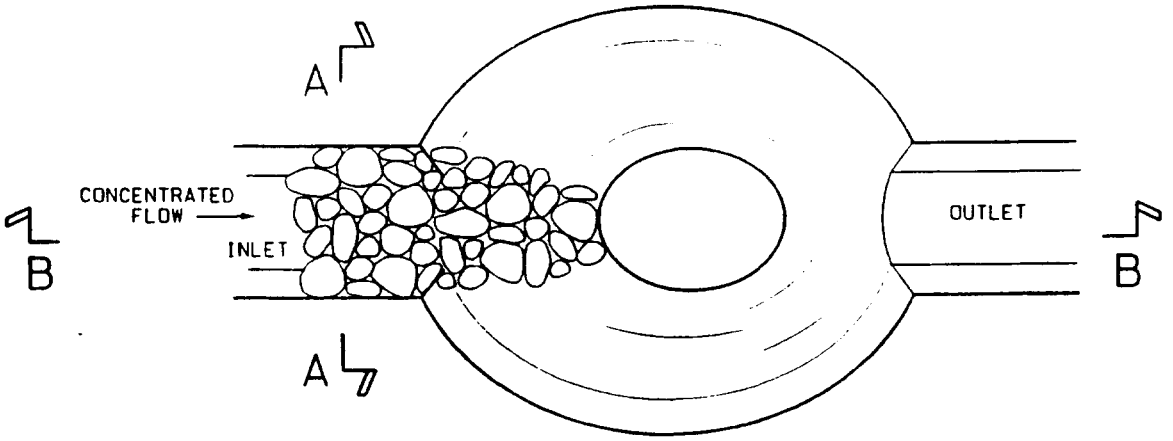
SEDIMENT TRAP



SECTION A-A



SECTION B-B



PLAN VIEW

SECTION 13 Stabilized Construction Entrance

PURPOSE & OPERATION

Stabilized construction entrances help to remove soil and mud from vehicles that exit construction sites. These features are effective measures that reduce off-site tracking, dust and possible sediment discharge to downstream storm water conveyance systems.

DESIGN

The stabilized construction entrance should be located where construction traffic leaves and enters the construction site. When a construction vehicle drives over the gravel pad, sediment and mud are removed from the vehicle's wheels, thereby reducing off-site tracking on to local roads and streets. Usually, these locations will occur at access points to local paved roads and highways.

INSTALLATION

Gravel Pad

A pad of gravel approximately 6 inches thick is placed at the entrance to the construction site. The gravel pad should be flared at the intersection to adjacent roadways so that longer vehicles remain on the gravel pad when turning out of or on to the site. A geotextile layer should be placed between the gravel layer and the subgrade. The size of the gravel should be large enough so that it is not carried away by vehicle traffic but small enough to not be caught between dual wheels. The gravel pad can also reduce erosion and rutting at the construction site entrance.

Cattle Guard/Metal Grate

A metal grate can be added to the gravel pad measure described above which will enhance the performance of the construction entrance. As vehicles drive over the series of parallel steel bars, soil is dislodged from vehicle tires.

All construction entrances should be maintained until the entire project site has been stabilized. Additional gravel may need to be added in order for the entrance to remain effective. Soil that is tracked off-site should be swept up and properly disposed as soon as possible.

ADDITIONAL RESOURCES

If you wish to learn more about temporary erosion control, the following resources may be helpful.

TEMPORARY EROSION CONTROL

- ***Best Management Practices for Erosion and Sediment Control.*** Report No. FHWA FLP-94-005. A copy of this publication can be obtained from FHWA at:

  U.S. Department of Transportation
  Federal Highway Administration
  Federal Lands Highway Program
  Washington, DC 20590

- ***Volume III.- AASHTO Guidelines for Erosion and Sediment Control in Highway Construction.***

SWPPP Inspection Checklist

Project:_____ Inspection: ___Weekly ___ Rain Event ___ Other

Date: _____ Weather:_____

Control Codes

B = Berm	EV = Equip / Veh. Wash Down Area	SD = Slope Drain
BL = Bio Log	GD = Gravel Check Dam	SCE = Stabilized Const. Entrance
BB = Brush Barrier	MS = Material Storage	SLD = Stone Lined Ditch
CL = Channel Liner	M = Mulching	SBB = Straw Bale Barrier
D = Dike	R = Riprap	SR = Surface Roughening
DP = Drop-inlet Protection	PP = Pipe-inlet Protection	ST = Sediment Trap
ECB = Erosion Control Blanket	SB = Silt Bag	WD = Waste Disposal
EF = Environmental Fence	SF = Silt Fence	WB = Water Bar

Action Items

#	Code	Station	Description
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			

Prioritization Action Items: _____ Reoccurring Action Items: _____

Overall Evaluation of Project: (Rank from 0 to 10)
0 = Project in noncompliance - No implementation erosion control.
5 = Project in compliance - Needs improvement.
10 = Project in full compliance - No action items needed.

Contractor's ECS signature _____

UDOT's ECS signature _____